Department of Mechanical Engineering
Scheme of Studies 2025 for Mechanical Engineering
Scheme of Studies for Mechanical Engineering Curriculum

Annex-2

Program Salient Features

The undergraduate engineering program has been based on the following salient features:

- Eligibility: As per PEC Criteria
- Duration: 4 years
- Number of Semesters: 8
- Total Number of Credit Hours: **137**
- Number of Weeks per Semester: **16 - 18**
- Number of Credit Hours per Semester: **15 – 19**

1st Year						
First Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	HS-102	Islamic Studies/ Ethics	2	0	2	---None---
2.	GS-101	Calculus and Analytical Geometry	3	0	3	---None---
3.	HS-101	Functional English	3	0	3	---None---
4.	GS-102	Applied Physics	2	1	3	---None---
5.	CS-101	Applications of ICT	2	1	3	---None---
6.	ME-111	Engineering Drawing and Graphics	1	1	2	---None---
7.	ME-112	Workshop Practice	1	1	2	---None---
8.	RS -101	Understanding of Quran – I/Civics & Community Engagement-I (For Non-Muslims)	0	1	1	--------
		Total	**14**	**5**	**19**	

1st Year						
Second Semester						
Sr.No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	GS-103	Linear Algebra & Differential Equations	3	0	2	GS-101
2.	EE-101	Electrical Engineering	2	0	3	---None--
3.	ME-121	Computer Aided Drawing	0	1	1	ME-111
4.	ME-122	Engineering Mechanics-I, Statics	3	0	3	GS-102
5.	ME-123	Thermodynamics-I	3	0	3	------
6.	CS-102	Computer System & Programming	2	1	3	------
7.	HS-121	Civics & Community Engagement	2	0	2	------
8.	HS-122	Ideology & Constitution of Pakistan	2	0	2	------
		Total	**17**	**2**	**19**	

2nd Year						
Third Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	ME-211	Engineering Mechanics-II, Dynamics	2	0	2	ME-122
2.	ME-212	Mechanics of Materials-I	3	0	3	GS-102
3.	EE-201	Electronics Engineering	2	0	2	EE-101
4.	GS-201	Complex Variables & Transforms	3	0	3	GS-101
5.	ME-213	Fluid Mechanics-I	3	0	3	GS-101
6.	ME-214	Thermodynamics-II	2	0	2	ME-123
7.	MEL-211	Engineering Mechanics Lab	0	1	1	------
8.	MEL-214	Thermodynamics Lab	0	1	1	------
9.	EEL-201	Electrical & Electronics Engineering Lab	0	1	1	EE-101
10.	RS - 200	Understanding of Quran – II/Civics & Community Engagement-II (For Non-Muslims)	0	1	1	------
		Total	**15**	**4**	**19**	

2nd Year						
Fourth Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	ME-221	Instrumentation & Measurement	2	0	2	EE-101
2.	ME-222	Mechanics of Materials-II	3	0	3	ME-212
3.	ME-223	Fluid Mechanics-II	2	0	2	ME-213
4.	ME-224	Machine Design-I	2	0	2	ME-111
5.	ME-225	Materials Engineering	2	0	2	ME-212
6.	HS-221	Expository Writing	3	0	3	HS-101
7.	MEL-223	Fluid Mechanics Lab	0	1	1	------
8.	MEL-222	Mechanics of Materials Lab	0	1	1	------
		Total	**14**	**2**	**16**	

3rd Year						
Fifth Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	ME-313	Manufacturing Processes	2	0	2	ME-212
2.	MEL-313	Manufacturing Process Lab	0	1	1	
3.	ME-315	Mechanics of Machines	2	0	2	ME-212
4.	ME-314	Control Engineering	2	0	2	EE-201
5.	ME-312	Heat & Mass Transfer	3	0	3	ME-213
6.	CS-311	Applied Artificial Intelligence & Machine Learning	2	1	3	CS-102
7.	MEL-314	M & I and Control Lab	0	1	1	CS-102
8.	GS-311	Numerical Analysis	2	0	3	GS-103
9.	HS - 301	Pakistan Studeis	2	0	2	HS - 122
		Total	**15**	**3**	**18**	

3rd Year						
Sixth Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	SS-3XX	Social Science Elective	2	0	2	------
2.	ME-322	Heating, Ventilating & Air Conditioning	3	0	3	ME-123 ME-213
3.	ME-321	Machine Design-II	2	0	2	ME-224
4.	ME-323	Finite Element Methods	2	1	3	ME-222
5.	MEL-322	HVAC and H&M Lab	0	1	1	------
6.	GS-321	Probability & Stochastic/ Math Elective	3	0	3	GS-101
7.	MS-321	Project Management	2	0	2	------
8.	HS - 302	Cooperative Housing Societies	N/C	N/C	One Lecture per week (2 Contact hours)	------
		Total	**14**	**2**	**16**	

4th Year						
Seventh Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	ME-411	Mechanical Vibrations	3	0	3	ME-211
2.	ME-412	Internal Combustion Engines	2	1	3	ME-214 ME-223
3.	ME-4XX	Technical Electives-I	3/2	0/1	3	------
4.	HS-4XX	Arts & Humanities Elective	2	0	3	------
5.	MEL-411	Mechanisms and Mechanical Vibrations	0	1	1	------
6.	ME-413	Final Year Design Project-I	0	3	3	------
		Total	**10/9**	**5/6**	**15**	

4th Year						
Eighth Semester						
Sr. No	**Course Code**	**Course Title**	**(Credit Hours)**		**Total Credit Hours**	**Pre-requisite Courses**
			Theory	**Lab**		
1.	ME-421	Reverse Engineering & Inspection	2	1	3	------
2.	ME-422	Mechatronics & Robotics Engineering	2	1	3	ME-211 CS-311
3.	ME-4XX	Technical Electives-II	3/2	0/1	3	------
4.	MS-421	Entrepreneurship	2	0	2	------
5.	ME - 420	Occupational Health & Safety	1	0	1	------
6.	ME-423	Final Year Design Project-II	0	3	3	------
		Total	**10/9**	**5/6**	**15**	

Chairmen , DME

LIST OF ELECTIVES

****List of Technical Electives(3 Cr hrs.)
• Renewable Energy Technology • Finite Element Analysis • Maintenance Engineering • Power Plant

* List of Arts and HumanitiesElectives (2+0)
• Professional Ethics • Elementary Chinese • Philosophy

List of Social Sciences Electives(2+0)
• Organizational Behavior • Engineering Economics • Psychology

FIRST SEMESTER

Functional English

Credits: 3+0
Pre-Requisite: Nil
Course Code: HS-101

COURSE OUTLINE
This course is designed to equip students with essential language skills for effective communication in diverse real-world scenarios. It focuses on developing proficiency in English language usage: word choices, grammar and sentence structure. In addition, the course will enable students to grasp nuanced messages and tailor their communication effectively through application of comprehension and analytical skills in listening and reading. Moreover, the course encompasses a range of practical communication aspects including professional writing, public speaking, and everyday conversation, ensuring that students are equipped for both academic and professional spheres. An integral part of the course is fostering a deeper understanding of the impact of language on diverse audiences. Students will learn to communicate inclusively and display a strong commitment to cultural awareness in their language use. Additionally, the course will enable them to navigate the globalized world with ease and efficacy, making a positive impact in their functional interactions.

Islamic Studies

Credits: 3+0
Pre-Requisite: Nil
Course Code: IS-101

COURSE OUTLINE
This course is designed to provide students with a comprehensive overview of the fundamental aspects of Islam, its beliefs, practices, history and influence on society. It will further familiarize students with a solid foundation in understanding the religion of Islam from an academic and cultural perspective. Through this course, students will have an enhanced understanding of Islam's multifaceted dimensions which will enable them to navigate complex discussions about Islam's historical and contemporary role, fostering empathy, respect, and informed dialogue.

APPLIED PHYSICS

Credit: 2+1
Pre-Requisites: Nil
Course Code: GS-102

COURSE OUTLINE
Applied Physics covers fundamental and advanced concepts in physics with practical applications. The course begins with vector analysis, mechanics, and progresses through electrostatics and magnetism, including Gauss's and Am- pere's laws. Semiconductor physics, waves and oscillations, optics and lasers are explored, along with modern physics topics like black body radiation, the photoelectric effect, and nuclear reactions. Students will engage in real-world problem-solving across various physical phenomena.

Applications of ICT

Credits: 2+1
Pre-Requisite: Nil
Course Code: CS-101

COURSE OUTLINE
This course is designed to provide students with an exploration of the practical applications of Information and Communication Technologies (ICT) and software tools in various domains. Students will gain hands-on experience with a range of software applications, learning how to leverage ICT to solve daily life problems, enhance productivity and innovate in different fields. Through individual and interactive exercises and discussions, students will develop proficiency in utilizing software for communication, creativity, and more.

Engineering Drawing and Graphics

Credit: 1+1
Pre-Requisites: Nil
Course Code: GS-102

COURSE OUTLINE
Sketch Entities including Lines, Rectangles, Parallelogram, Circles, Arcs,Polygons, Sketch Editing Tool including Trimming, Extend Entities, Offset Entities, Move Entities, Copy Entities, Rotate Entities, Scale Entities, Stretch Entities, Mirror Entities, Linear Sketch Pattern, Circular Sketch Pattern,Building 3D Geometry including Extruded Boss/Base, Revolved Boss/Base, Lofted Boss/Base, Sweep Boss/Base, Mirroring, Linear Pattern, Circular Pattern, Removing Materials in 3D Geometry (Extruded Cut, Revolve Cut, Lofted Cut, Sweep Cut, Fillet and Chamfer, Shell, Draft), Assembly, Internal and External Threads, Drawing Template, Sheet Metal Work, Working with Equations.

Calculus and Analytical Geometry

Credit: 3+0
Pre-Requisites: Nil
Course Code: GS-101

COURSE OUTLINE
Calculus and Analytical Geometry offers a comprehensive exploration of mathematical principles, covering analytical geometry with vector and scalar products, three-dimensional coordinates, and the equations of lines and planes. The course delves into functions, limits, continuity, and differentiation, including higher-order derivatives and applications like optimization and curvature. Integration techniques are examined in depth, along with their applications to areas, volumes, and center of mass calculations. Additionally, the course covers improper integrals, infinite sequences and series, and power and Taylor series, providing a robust foundation in calculus and its practical applications.

Workshop Practice

Credit: 1+1
Pre-Requisites: Nil
Course Code: ME-112

COURSE OUTLINE
Workshop Practice introduces hands-on skills in various manufacturing and fabrication techniques, including bench work, fitting, electrical shop tasks, casting, machining, welding, sheet metal work, carpentry, blacksmithing, and foundry operations. The course covers primary and secondary shaping processes, metal joining methods, and surface finishing. Students will also learn about modern tool usage, such as die casting and metal casting, essential for practical engineering applications.

SECOND SEMESTER

Linear Algebra and Differential Equations

Credit: 3+0
Pre-Requisites: Nil
Course Code: GS-103

COURSE OUTLINE
This course will give students a detailed understanding of Linear Algebra and Differential equations. The course will provide detailed guidance on Linear Algebra and Differential equations employed in the field of Chemical engineering. The main focus on solving the real problems of mechanical engineering using Linear Algebra and Differential equations.

Electrical Engineering

Credit: **3+0**
Pre-Requisites: **Nil**
Course Code: **EE-101**

COURSE OUTLINE
This course covers the fundamental concepts of electrical engineering as listed below in course outline/lecture schedule. Being used and implied by Mechanical Engineering students during their course of study and application of Mechanical Engineering.

Computer Aided Drawing

Credit: **3+0**
Pre-Requisites: **ME-111**
Course Code: **ME-121**

COURSE OUTLINE
Sketch Entities including Lines, Rectangles, Parallelogram, Circles, Arcs, Polygons, Sketch Editing Tool including Trimming, Extend Entities, Offset Entities, Move Entities, Copy Entities, Rotate Entities, Scale Entities, Stretch Entities, Mirror Entities, Linear Sketch Pattern, Circular Sketch Pattern, Building 3D Geometry including Extruded Boss/Base, Revolved Boss/Base, Lofted Boss/Base, Sweep Boss/Base, Mirroring, Linear Pattern, Circular Pattern, Removing Materials in 3D Geometry (Extruded Cut, Revolve Cut, Lofted Cut, Sweep Cut, Fillet and Chamfer, Shell, Draft), Assembly, Internal and External Threads, Drawing Template, Sheet Metal Work, Working with Equations.

Engineering Mechanics -I; Statics

Credit: **3+0**
Pre-Requisites: **GS-102**
Course Code: **ME-122**

COURSE OUTLINE
Engineering Mechanics-I (Statics) introduces fundamental concepts of mechanics, including force systems, equilibrium conditions, and structural analysis. Topics cover force vectors, moments, free body diagrams, equilibrium in two and three dimensions, trusses (2D and 3D), frames, machines, friction, and center of gravity. The course provides a solid foundation in statics essential for understanding structural and mechanical systems.

Thermodynamics – I

Credit: **3+0**
Pre-Requisites: **Nil**
Course Code: **ME-123**

COURSE OUTLINE
Thermodynamics is an engineering science linked to most mechanical engineering applications. This course provides an introduction to the thermodynamic concepts, required in courses to follow as well in professional applications. The objective of the course is to develop understanding of energy systems such as engines and refrigeration systems.

Computer System & Programming

Credit: **2+1**
Pre-Requisites: **Nil**
Course Code: **CS-102**

COURSE OUTLINE
Computer Systems and Programming introduces the fundamentals of computer hardware and software, covering the history of computing, data representation, number systems, networks, memory, storage devices, and operating systems. The course also delves into basic programming concepts, including algorithms, flowcharts, pseudocode, control structures, arrays, loops, and the use of library functions and header files. Students will gain a solid foundation in both the theoretical and practical aspects of computing.

Civics and Community Engagement

Credit: **2+0**
Pre-Requisites: **Nil**
Course Code: **HS-102**

COURSE OUTLINE
This course is designed to provide students with fundamental knowledge about civics, citizenship, and community engagement. In this course, the students will learn about the essentials of civil society, government, civic responsibilities, inclusivity, and effective ways to participate in shaping the society which will help them apply theoretical knowledge to the real-world situations to make a positive impact on their communities.

Ideology & Constitution of Pakistan

Credit: **2+0**
Pre-Requisites: **Nil**
Course Code: **HS-122**

COURSE OUTLINE
This course is designed to provide students with a fundamental exploration of the ideology and the constitution of Pakistan. The course focuses on the underlying principles, beliefs, and aspirations that have been instrumental in shaping the creation and development of Pakistan as a sovereign state. Moreover, the course will enable students to understand the core provisions of the Constitution of the Islamic Republic of Pakistan concerning the fundamental rights and responsibilities of Pakistani citizens to enable them function in a socially responsible manner.

THIRD SEMESTER

Engineering Mechanics -II; Dynamics

Credit: **2+1**
Pre-Requisites: **ME-122**
Course Code: **ME-221**

COURSE OUTLINE
Engineering Mechanics-II (Dynamics) delves into Newtonian mechanics, covering kinematics and kinetics of particles and rigid bodies. Topics include rectilinear, curvilinear, and constrained motion, along with equations of motion, work-energy principles, linear impulse and momentum, impact analysis, angular momentum, and motion relative to moving reference frames. This course provides a comprehensive understanding of dynamic systems and their behavior in engineering applications.

Mechanics of Materials-I

Credit: **3+0**
Pre-Requisites: **GS-102**
Course Code: **ME-212**

COURSE OUTLINE
Mechanics of Materials-I delves into equilibrium principles, material behavior, and load types, covering direct stresses and strains, Hooke's law, and mechanical properties. The course also includes thermal stresses, failure modes, and stresses in simple and composite bars, along with torsion, bending stresses, beam deflection, and shear stresses in beams using various methods. Students gain a comprehensive understanding of structural analysis and material behavior under different conditions.

Fluid Mechanics – I

Credit: **3+0**
Pre-Requisites: **GS-102**
Course Code: **ME-213**

COURSE OUTLINE
This course develops the basics of fluid mechanics and a prerequisite for subsequent courses in the thermal-fluid area. The course defines a fluid, describes its properties, and derives governing equations from basic principles. It also supports the students in mathematical development. Both integral and differential approaches are presented and simplifying assumptions and equations are discussed and applied.

Complex Variables & Transforms

Credit: **3+0**
Pre-Requisites: **GS-101**
Course Code: **GS-201**

COURSE OUTLINE
Complex Variables & Transforms covers the fundamentals of complex numbers and functions, with applications in engineering. The course explores complex differentiation and integration, including the Cauchy-Riemann equations and Cauchy's integral theorems. Students will delve into power series, conformal mappings, and residue theory, as well as Laplace transformations and their applications. Special functions and Fourier transforms are examined in depth, alongside Z-transforms and their use in solving difference equations.

Thermodynamics – II

Credit: **2+1**
Pre-Requisites: **Nil**
Course Code: **ME-214**

COURSE OUTLINE
This course teaches the application of Thermodynamics and prepares students for subsequent courses in the thermal-fluid area. The course prepares the student to apply the principles of Thermodynamics in power plants and Refrigeration cycles systems. It also supports the students in mathematical development. Both integral and differential approaches are presented and simplifying assumptions and equations are discussed and applied.

Electronics Engineering

Credit: **2+1**
Pre-Requisites: **EE-101**
Course Code: **EE-201**

COURSE OUTLINE
This course covers the fundamental concepts of electronics engineering as listed below in course outline/lecture schedule. Being used and implied by Mechanical Engineering students during their course of study and application of Mechanical Engineering.

FOURTH SEMESTER

Instrumentation & Measurement

Credit: **2+0**
Pre-Requisites: **Nil**
Course Code: **ME-201**

COURSE OUTLINE
Introduction to measurement standards, design of experiment, major blocks of a measurement system, introduction to instruments, statics and dynamic characteristics of instruments, analog and digital signals, active and passive filters, temperature measurement, pressure measurement, position measurement, hall-effect sensing and application, piezoelectric sensors and applications, design of a sensor, data acquisition systems and post-processing/data analysis, test rig development

Mechanics of Materials-II

Credit: **3+1**
Pre-Requisites: **ME-212**
Course Code: **ME-222**

COURSE OUTLINE
This course continues the development of elastic solid mechanics. Areas covered are shear stresses in bending, stress transformation and principal stresses, deflection of statically determinate beams and an introduction to the analysis of statically indeterminate beams, elastic buckling of columns. Engineering design concepts are integrated throughout the course.

Fluid Mechanics – II

Credit: **2+1**
Pre-Requisites: **ME-213**
Course Code: **ME-223**

COURSE OUTLINE
This course teaches two- and three-dimensional ideal fluid flow Potential flow, circulation, stream function and velocity potential, uniform flow, two-dimensional source and sink, vortex, the doublet, lift and drag forces. Two- and three-dimensional viscous fluid flow Navier stokes equations of motion, two-dimensional flow between parallel plates, flow in a circular pipe, creep flow, Reynold's equation, and hydrodynamic lubrication in journal bearing. Boundary layer theory Boundary layer theory, laminar & turbulent boundary layers, boundary layer control, airfoil cascades. Fluid machinery Similarity relations for turbo machines, specific speed, classification of turbo machines, impulse turbines, reaction turbines, hydraulic jacks, pumps and their performance curves.

Machine Design – I

Credit: **2+0**
Pre-Requisites: **Nil**
Course Code: **ME-224**

COURSE OUTLINE
Machine Design and CAD-I is the first course offered to ME students that introduces them with the design standards and designs of basic machine components. The course first introduces the philosophy of design procedure and design standards and then gradually covers the design of common machine elements. The students are expected to prepare professional quality solutions and communicate the results of analysis and design, effectively

Expository Writing

Credit: **3+0**
Pre-Requisites: **HS-101**
Course Code: **HS-221**

COURSE OUTLINE
Expository Writing is a sequential undergraduate course aimed at refining writing skills in various contexts. Building upon the foundation of the pre- requisite course, Functional English, this course will enhance students' abilities of producing clear, concise and coherent written texts in English. The course will also enable students to dissect intricate ideas, to amalgamate information and to express their views and opinions through well-organized essays. The students will further be able to refine their analytical skills to substantiate their viewpoints using credible sources while adhering to established ethical writing norms. Additionally, the course will highlight the significance of critical thinking enabling students to produce original and engaging written texts.

Materials Engineering

Credit: **2+0**
Pre-Requisites: **ME-212**
Course Code: **ME-225**

COURSE OUTLINE
Materials Engineering delves into the fundamentals of materials science, covering atomic bonding, crystalline structures, imperfections, and mechanical properties. The course also explores phase diagrams, phase transformations, and the development of microstructures. Additionally, it discusses the applications, processing, and testing of metallic, non-metallic, and composite materials, along with corrosion prevention methods and material degradation.

FIFTH SEMESTER

Manufacturing Processes

Credit: **2+1**
Pre-Requisite: **ME-212**
Course Code: **ME-313**

COURSE OUTLINE
This course teaches about manufacturing processes like "Metal Casting Process & Equipment. Molding and molding sands, foundry practices, casting and its types, pattern and pattern making, molding tools and foundry equipment, permanent mold casting. "Forming & Shaping Plastics & Composite Materials. Extrusion, injection molding, blow molding, thermo-forming, processing elastomers, polymer foam processing and forming, processing metal matrix and ceramic matrix composites. "Powder Metallurgy. Production of metal powders, compaction, sintering, design considerations. "Forming & Shaping Processes and Equipment. Rolling, various rolling processes and milling, Extrusion and Drawing, Extrusion and drawing equipment, Forging. "Sheet Metal Forming. Sheet metal characteristics and formability, bending sheet and plate, tube bending, deep drawing, supper plastic forming, equipment for sheet metal forming.

Mechanics of Machines

Credit: **2+0**
Pre-Requisite: **ME-212**
Course Code: **ME-315**

COURSE OUTLINE
This course is about the design and synthesis of mechanisms, machines and the underlying concepts of kinematics. It starts with the discussion about fundamental concepts, for example links, joints, kinematics chains and degrees of freedom of the planar mechanisms. Special emphasis is given to enhance the student capability in building analytical models of mechanisms. This will enable students to characterize the mechanisms before making or bringing the mechanisms into realization.

Control Engineering

Credit: **2+0**
Pre-Requisite: **ME-212**
Course Code: **ME-315**

COURSE OUTLINE
This class introduces students to the modeling, analysis and design of linear feedback control systems. Students gain experience in applying a variety of modeling techniques and analyzing system performance from several perspectives to include the time and frequency domains as well as state space formulations. Students learn to synthesize linear controllers capable of satisfying a variety of stability and response criteria by using both classical and modern design techniques

Heat and Mass Transfer

Credit: **3+0**
Pre-Requisite: **ME-123 & ME-213**
Course Code: **ME-312**

COURSE OUTLINE
This course teaches the basics of Heat and Mass Transfer and prepares students for subsequent courses in the thermal-fluid area. The course provides detailed understanding of modes of heat transfer i.e. Conduction, Convection and Radiations. This course also covers boiling and condensation, Mass Transfer and Heat exchangers.

Applied Artificial Intelligence & Machine Learning

Credit: **2+1**
Pre-Requisite: **CS-201**
Course Code: **CS-311**

COURSE OUTLINE
Applied AI & Machine Learning course aim to equip the students' exposure to emerging trends in the field of AI and machine learning

Numerical Analysis

Credit: **2+1**
Pre-Requisite: **GS-103**
Course Code: **GS-311**

COURSE OUTLINE
• Error Analysis and Interpolation • Numerical Differentiation and Integration • Methods of solution a system of Linear Equations • Iterative Methods for Linear and Nonlinear Equations • Numerical Methods for IVPs and BVPs • Numerical Methods for Computing Eigenvalues • Numerical Optimization
COURSE OUTLINE (PRACTICALS)
Labs/ Practical: The course practical/labs should be defined and synchronized with the course outline

SIXTH SEMESTER

Heating Ventilating and Air Conditioning

Credit: **3+1**
Pre-Requisite: **ME-123 & ME-213**
Course Code: **ME-322**

COURSE OUTLINE
This course is an introduction to the design of thermal systems for indoor climate control. The concepts, design, application and control of air conditioning and refrigeration are introduced through the use of fundamentals of thermo-fluids. The course is designed to provide a balance among theory and practical design principles and to introduce the students with real world problems of air conditioning and refrigeration design and applications.

Machine Design – II

Credit: **2+0**
Pre-Requisite: **ME-213**
Course Code: **ME-322**

COURSE OUTLINE
Machine design is a core course that equips students with the basics of mechanical engineering design. It prepares students for the engineering problems encountered and everyday life. Knowledge of Statics, Dynamics and Mechanics of Materials is a pre-requisite for a better understanding of fundamental design concepts.

Probability & Stochastics

Credit: **3+0**
Pre-Requisite: **GS-101**
Course Code: **GS-321**

COURSE OUTLINE
This course provides the students with a deeper understanding about the theory of probability and the concepts of stochastics theory and analysis.

Project Management

Credit: **2+0**
Pre-Requisite: **Nil**
Course Code: **MS-321**

COURSE OUTLINE
The primary objective of this course is to get the fair understanding of core issues pertaining to Engineering Project Management. This course is aimed at providing both basic and some advanced exposure to emerging trends in the field of Project Management, so as to enable the engineering professionals of tomorrow to successfully complete sophisticated projects within the constraints of capital, time, and other resources with due regards to stakeholders set of expectations. Engineering students will learn key Project Management skills and strategies and will be able to face emerging challenges.

Finite Element Methods

Credit: **2+1**
Pre-Requisite: **Nil**
Course Code: **MS-222**

COURSE OUTLINE
The course provides advanced knowledge on the application of finite element analysis to engineering applications in linear structural mechanics and heat transfer problems. The course analyses critically problems involving one, two- and three-dimensional idealizations. The topics covered include steps in finite element modelling process, behavior of spring, truss, beam, plane stress/strain and three-dimensional finite element modelling approaches in structural mechanics. The heat transfer part of the course examines the conduction and convection behavior and analyzing these mechanisms using finite element analysis.

SEVENTH SEMESTER

Mechanical Vibrations

Credit: **3+1**
Pre-Requisite: **ME-211**
Course Code: **ME-411**

COURSE OUTLINE
This course deals with observation, analysis, and modification of vibration in mechanical systems. In addition to analysis and experimentation, practical applications and design considerations related to modifying the vibrational behavior of mechanical devices and structures will also be studied. This understanding is important for humans, particularly engineers, as there are desirable types of vibration and undesirable vibrations. The course gives knowledge of vibrations in rotating and oscillating bodies. Fundamental analysis in frequency and in time domain. Response analysis, of free and forced vibrations.

Internal Combustion Engine

Credit: **2+1**
Pre-Requisite: **ME-214 % ME-223**
Course Code: **ME-412**

COURSE OUTLINE
The course provides introductory overview of spark ignition and compression ignition engines. Describes combustion chemistry, and identifies the parameters and engine operations to develop understanding of the thermodynamics and combustion process for a quantitative analysis of internal combustion engines. Detail of gas exchange and inflow and outflow of gases explained. Engine classification, engine cycle, combustion processes, reaction of engine fuels, release of energy and ultimate conversion into useful work is illustrated. A concise discussion on topics like performance of engines, Knocking, Octane number, Cetane number, engine valve timing, ignition advance/ retard, and working principle of turbo-charged engine is also included. Highlighting that Internal Combustion Engines are a source of pollution and controlling the emissions is emphasized.

EIGHTH SEMESTER

Entrepreneurship

Credit: **2+0**
Pre-Requisite: **Nil**
Course Code: **MS-421**

COURSE OUTLINE
This course is designed to promote entrepreneurial spirit and outlook *among* students, encouraging them to think critically, identify opportunities, and transform their ideas into successful ventures. It aims at imparting them with the requisite knowledge; skills and abilities, enabling them to seize the identified opportunities for initiating ventures and successfully navigating the challenges that come with starting business and managing it. The course covers topics relevant to entrepreneurship including setting up and initiation of business (including requirements for registration and incorporation with regulators such as SECP and others), market research, opportunity identification, business planning, financial literacy for managing finances and securing funding, marketing and sales, team building and innovation. Overall, the course is geared towards personal growth and professional development for pursing innovative ideas, availing opportunities and initiating start-ups.

Mechatronics & Robotics Engineering

Credit: **2+1**
Pre-Requisite: **Nil**
Course Code: **MS-421**

COURSE OUTLINE
This course is aimed to acquire fundamental knowledge for electro-mechanical design and to develop synergistic integration of mechanical, electrical, electronic engineering applications.

Occupational Health and Safety

Credit: **1+0**
Pre-Requisite: **Nil**
Course Code: **MS-421**

COURSE OUTLINE
This course introduces the student to the study of workplace occupational health and safety. The student will learn safe work practices in offices, industry and construction as well as how to identify and prevent or correct problems associated with occupational safety and health in these locations as well as in the home.

Reverse Engineering & Inspection

Credit: **2+1**
Pre-Requisite: **Nil**
Course Code: **ME-421**

COURSE OUTLINE
Introduction to Reverse Engineering (Definition and significance, Applications in industrial engineering, Legal and ethical considerations); Reverse Engineering Process(Data acquisition methods (3D scanning, coordinate measuring), Point cloud data processing, CAD modeling from scan data); Inspection Techniques (Geometric dimensioning and tolerancing (GD&T), Coordinate measuring machines (CMM), Optical and non-contact inspection methods); Surface and Material Analysis (Surface roughness measurement, Material composition analysis, Non-destructive testing methods); Metrology and Measurement Standards (Introduction to metrology, International measurement standards, Calibration and traceability); Reverse Engineering Software Tools (Introduction to software for data processing and CAD modeling, Hands-on experience with software tools); Applications of Reverse Engineering under Industry 4.0 Perspective; Case studies in various industries (e.g., automotive, aerospace), Practical projects in reverse engineering and inspection under fourth industrial revolution